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QUARTERLY REPORT

Project Title: Performance Evaluation of High-Strength Steel Pipelines for High-Pressure Gaseous Hydrogen Transportation

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Public Page for Quarter Ending December 27, 2010

Project #294: Performance Evaluation of High-Strength Steel Pipelines for High-Pressure Gaseous Hydrogen Transportation

Background

Hydrogen is being considered as a promising candidate for alternative fuels. One key component of the hydrogen infrastructure is the delivery systems from the point of production to the point of use. Transporting gaseous hydrogen via existing pipelines is recognized as one of the most cost-effective options for delivering large volume of hydrogen. One of the major safety concerns has been performance degradation of pipeline materials under a high-pressure hydrogen environment. With extended exposure to high-pressure hydrogen, the mechanical properties of pipeline steels, including their tensile and yield strengths, fracture toughness, and crack-growth rate, may deteriorate. This could lead to significant reduction of service life of pipeline. As more and more high-strength pipelines have been put into service, there is a need for materials performance data under high-pressure hydrogen environment for high-strength steels. This project is intended to address these challenges. The objectives of this project are to produce performance data for high-strength steels used in hydrogen pipelines, use mechanistic-based analysis procedures and models for correlating the test data and predicting material behaviors under practical conditions. The test data and the analysis results will be used to enable updates and revisions of relevant industrial codes and standards.

Progress in the Quarter

The project activities undertaken in the fifth quarter included the initiatives for project contract modification that includes expansion of work scope, increase of budget, and extension of project duration. Progresses have been made in Task 2, Development of Test Equipment, Task 3, Fixture and Specimen Machining, and Task 4, Test Matrix Design.

The contract modification includes the addition of a PREP graduate student to the project and an 18-monthly project extension. Federal fund and matching cost-share by project team member have been approved. As the results of this contract modification, a new project schedule and a new payment schedule for fund transfer from CRES to NIST will be created. Under the coordination of Louis Hayden, information exchange and research collaboration between the current project and another DOT-sponsored project at Oak Ridge National Laboratory/University of Tennessee has continued.

A major technical development is that NIST has received the long hydrogen pressure chamber. This allows the formal start of installation of test equipment. The fabrications of the multi-specimen link system and its testing continued. All the testing materials are on site at NIST and efforts are being made to expedite the machining of specimens.